3.2 Connecting $y = mx + b$ and $ax + by = c$

There are two common forms of a linear equation.

- When the values of one variable depend on those of another, it is most natural to express the relationship as $y = mx + b$. Most of the linear equations you have seen have been in this *slope-intercept* form.
- When it is more natural to combine the values of two variables, the relationship can be expressed as $ax + by = c$. This is the *standard form* of a linear equation. The equations in Problem 3.1 were in standard form.

Getting Ready for Problem 3.2

It is easy to graph a linear equation of the form $y = mx + b$ on a calculator.

- Can you use a calculator to graph an equation of the form $ax + by = c$?
- Can you change an equation from $ax + by = c$ form to $y = mx + b$ form?
- How can rewriting the equation $600 = 5s + 10c$ (or $600 = 5x + 10y$) from Problem 3.1 in $y = mx + b$ form help you find solutions?

Problem 3.2 Connecting $y = mx + b$ and $ax + by = c$

A. Four students want to write $12x + 3y = 9$ in equivalent $y = mx + b$ form. Here are their explanations:

Jared

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= -12x + 9 \quad (1) \\ y &= -4x + 3 \quad (2) \end{aligned}$$

Molly

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= 9 - 12x \quad (1) \\ y &= 3 - 12x \quad (2) \end{aligned}$$

Ali

$$\begin{aligned} 12x + 3y &= 9 \\ 4x + y &= 3 \quad (1) \\ y &= -4x + 3 \quad (2) \end{aligned}$$

Mia

$$\begin{aligned} 12x + 3y &= 9 \\ 3y &= 9 - 12x \quad (1) \\ y &= 3 - 4x \quad (2) \\ y &= 4x - 3 \quad (3) \end{aligned}$$

1. Did each student get an equation equivalent to the original? If so, explain the reasoning for each step. If not, tell what errors the student made.
2. What does it mean for two equations to be equivalent?

B. Write each equation in $y = mx + b$ form.

1. $x - y = 4$
2. $2x + y = 9$
3. $8x + 4y = -12$
4. $12 = 3x - 6y$
5. $x + y = 2.5$
6. $600 = 5x + 10y$

C. Suppose you are given an equation in $ax + by = c$ form. How can you predict the slope, y-intercept, and x-intercept of its graph?

D. Write each equation in $ax + by = c$ form.

1. $y = 5 - 3x$
2. $y = \frac{2}{3}x + \frac{1}{4}$
3. $x = 2y - 3$
4. $2x = y + \frac{1}{2}$
5. $y - 2 = \frac{1}{4}x + 1$
6. $3y + 3 = 6x - 15$

ACE Homework starts on page 42.

3.3 Intersections of Lines

At a school band concert, Christopher and Celine sell memberships for the band's booster club. An adult membership costs $10, and a student membership costs $5.

At the end of the evening, the students had sold 50 memberships for a total of $400. The club president wants to know how many of the new members are adults and how many are students.